Chapter Review Exercises (page 340)

R5.1 When the weather conditions are like those seen today, it has rained on the following day about 30% of the time.

R5.2 (a) Let the numbers 00–14 represent drivers who do not have their seat belts on and 15–99 represent drivers who do have their seat belts on. Using the table of random digits, read 10 sets of 2-digit numbers. We do not need to discard repeated numbers because the numbers are not referring to specific individuals. For each set of 10 2-digit numbers, record whether there are two consecutive numbers between 00-14 or not.
(b) The first sample is 29 **07** 71 48 63 61 68 34 70 52. Those not wearing seat belts are in bold. In this sample there was only one not wearing a seat belt, so there were not two consecutive people not wearing their seat belts. The second sample is 62 22 45 **10** 25 95 **05** 29 **09 08**. In this sample there were two consecutive drivers not wearing their seatbelts (represented by 09 and 08). The third sample is 73 59 27 51 86 87 **13** 69 57 61. In this sample there were not two consecutive drivers not wearing their seat belts. Based on these three repetitions of the simulation, the probability of finding two consecutive people in a sample of 10 not wearing their seat belts is about 0.33. To get a more precise estimate of this probability, perform many more repetitions.

R5.3 (a) Die A can be either 6 or 2 and Die B can be either 5 or 1. So the difference (Die A – Die B) can take on 3 different values: $6-5=1$ or $2-1=1$, $6-1=5$, and $2-5=-3$. Because the outcomes when rolling the two dice are independent,

P(difference = 1) = $P(6\cap 5)+P(2\cap 1)=\left(\frac{2}{6}\right)\left(\frac{3}{6}\right)+\left(\frac{4}{6}\right)\left(\frac{3}{6}\right)=\frac{18}{36}$,

P(difference = 5) = $P(6\cap 1)=\left(\frac{2}{6}\right)\left(\frac{3}{6}\right)=\frac{6}{36}$, and

P(difference = –3) = $P(2\cap 5)=\left(\frac{4}{6}\right)\left(\frac{3}{6}\right)=\frac{12}{36}$.

Putting this all together we get

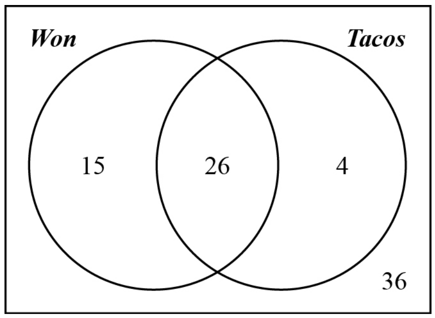
Difference	1	5	–3
Probability	$\frac{18}{36}$	$\frac{6}{36}$	$\frac{12}{36}$

(b) Die A is more likely to roll a higher number. When the difference is positive, we know that A had a higher number than B. Thus, the probability that A is greater than B is $\frac{18}{36}+\frac{6}{36}=\frac{24}{36}$.

R5.4 (a) It is legitimate because every person must fall into exactly one category, the probabilities are all between 0 and 1, and they add up to 1.
(b) The probability that a randomly chosen person is Hispanic is $0.001+0.006+0.139+0.003=0.149$.
(c) The probability that a randomly chosen person is not a non-Hispanic white is $1-0.674=0.326$.
(d) We cannot add their probabilities because the people who are white and Hispanic will be double counted because these events are not mutually exclusive.

$$P(\text{white or Hispanic})=P(\text{white})+P(\text{Hispanic})-P(\text{white}\cap\text{Hispanic})$$
$$=0.813+0.149-0.139=0.823.$$

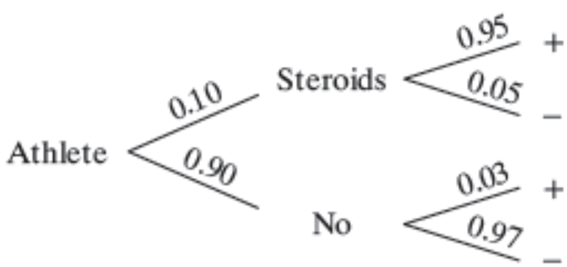
R5.5 (a)



(b) P(lost and no tacos) = 36/81 = 0.444. There is 0.444 probability that the Diamondbacks lost and no tacos were given away.

(c) P(won or tacos) = P(won) + P(tacos) – P(won and tacos) = $\frac{41}{81}+\frac{30}{81}-\frac{26}{81}=\frac{45}{81}=0.556.$ There is a 0.556 probability that the Diamondbacks won or fans got free tacos.

R5.6 (a)



(b) $P(+)=(0.10)(0.95)+(0.90)(0.03)=0.095+0.027=0.122.$ There is a 0.122 probability that a randomly selected athlete tests positive.

(c) $P(\text{steroids}\,|\,+)=\frac{P(\text{steroids}\cap +)}{P(+)}=\frac{0.095}{0.122}=0.7787.$ There is a 0.7787 probability that an athlete used steroids, given that the athlete tests positive.

R5.7 (a)

	Thick crust	**Thin crust**	**Total**
Mushrooms	2	2	**4**
No mushrooms	1	2	**3**
Total	**3**	**4**	**7**

(b) These events are not independent, because $P(\text{mushrooms})=\frac{4}{7}=0.571,$ but $P(\text{mushrooms}\,|\,\text{thick crust})=\frac{2}{3}=0.667.$ If the events had been independent, these probabilities would have been equal. Knowing that the pizza has thick crust makes it more likely that the pizza has mushrooms.

(c) Here is a new two-way table

	Thick crust	**Thin crust**	**Total**
Mushrooms	2	2	**4**
No mushrooms	2	2	**4**
Total	**4**	**4**	**8**

With the eighth pizza, $P(\text{mushrooms}) = \frac{4}{8} = \frac{1}{2} = 0.50,$ and

$P(\text{mushrooms} \mid \text{thick crust}) = \frac{2}{4} = \frac{1}{2} = 0.50,$ so these events are independent. Knowing the crust thickness doesn't help us predict if the pizza has mushrooms.

R5.8 (a) There are a total of 871 pine seedlings, of which 209 had damage from deer, so the probability of a randomly selected pine seedling having damage by deer is $\frac{209}{871} = 0.24.$

(b) $P(\text{damage} \mid \text{no cover}) = \frac{60}{211} = 0.2844,$ $P\left(\text{damage} \mid < \frac{1}{3}\right) = \frac{76}{234} = 0.3248,$

$P\left(\text{damage} \mid \frac{1}{3} \text{ to } \frac{2}{3}\right) = \frac{44}{221} = 0.1991,$ and $P\left(\text{damage} \mid > \frac{2}{3}\right) = \frac{29}{205} = 0.1415.$

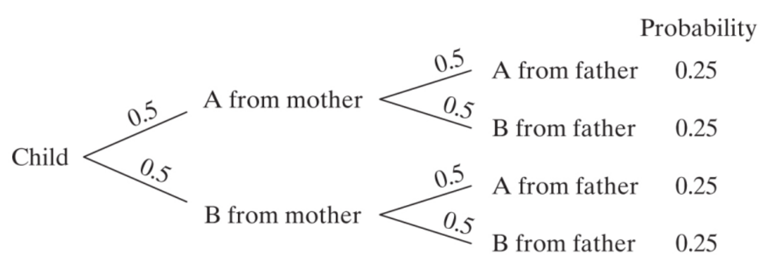
(c) Yes, knowing the amount of cover does change the probability of deer damage. It appears that deer do much more damage when there is no cover or less than 1/3 cover and much less damage when there is more cover than that.

R5.9 (a) $P(\text{up three consecutive years}) = [P(\text{up one year})]^3 = (0.65)^3 = 0.274625.$ There is a 0.275 probability that our portfolio goes up for three consecutive years.

(b) $P(\text{same direction for 3 years}) = P(\text{up 3 years}) + P(\text{down 3 years}) = (0.65)^3 + (0.35)^3$
$= 0.2746 + 0.0429 = 0.3175.$

There is a 0.3175 probability that our portfolio moves in the same direction for three consecutive years.

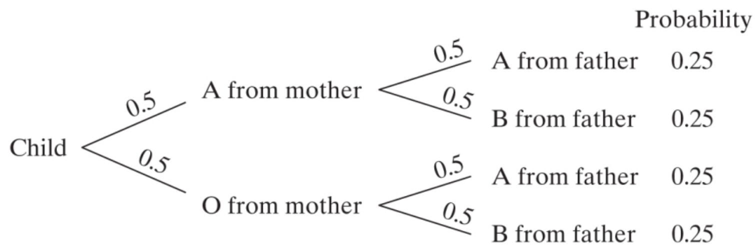
R5.10 (a)



The possible blood types and their probabilities are:

Blood type	A	AB	B
Probability	0.25	0.5	0.25

(b)



The possible blood types and their probabilities are:

Blood type	A	AB	B
Probability	0.5	0.25	0.25

So the probability that at least one of two children are type B is *P*(at least 1 type B) = 1 – *P*(neither are type B) = $1-(0.75)^2=0.4375$. There is a 0.4375 probability that at least one of the two children will have blood type B.